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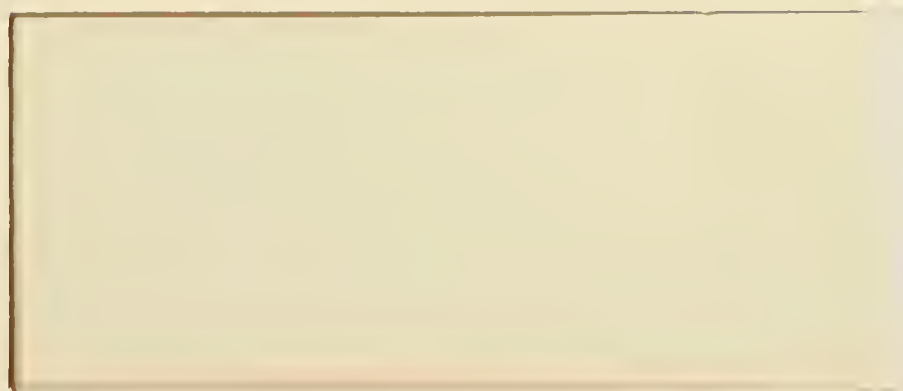
On the Development of Decision Support Systems
As a Marketing Problem*

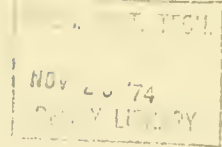
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ON THE DEVELOPMENT OF DECISION SUPPORT SYSTEMS
AS A MARKETING PROBLEM*

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Decision Support Systems are systems designed to support managers in unstructured and complex tasks. A marketing perspective on the design and implementation of Decision Support Systems is proposed: the manager is the consumer, and the information provided by the Decision Support System is the product purchased.

A marketing perspective suggests that a Decision Support System should be designed in the explicit context of the numerous competing and complementary products available to the manager, i.e., competing and complementary information sources. Furthermore, it is argued that manager perceptions of information sources is a key variable to be considered in the Decision Support System design and implementation process. Finally the Information Sources Role Construct Repertory Interview, an instrument to sample manager perceptions of information sources in a systematic fashion, is presented.

1. INTRODUCTION

Decision Support Systems is a label that has been proposed to designate systems that are designed to be used by managers in unstructured or unprogrammed tasks such as brand management, portfolio management, long range planning, and project management [4].

As argued by Gorry and Scott Morton [4], the issues facing the design and implementation of such systems are radically different from those faced in the design and implementation of Structured Decision Systems, a label given to systems that are designed to be used in relatively structured or programmed tasks such as inventory control, billing and accounts receivable, and payroll. As noted "...the Structured Decision Systems area encompasses almost all of what has been called Management Information Systems, an area ...that has been largely routine Data Processing..." [4]. In the case of Structured Decision Systems, one is typically faced with issues such as the management of large scale projects, systems efficiency, data base design, interfacing and integrating manual and automatic procedures. In the case of Decision Support Systems, on the other hand, some of the central problems are flexibility and adaptability, decision analysis, determination of information requirements, the availability and reliability of interactive computing services.

A number of different approaches have been proposed to tackle the particular problems faced in the design and implementation of a Decision Support System (DSS). Gerrity [3] has reviewed a number and suggests that a decision centered approach might overcome some of the major limitations of the other methods he reviews.

To us, the area of Management Information Systems cannot be considered a discipline, but is rather a problem area that will benefit most from a true inter-disciplinary effort. In the spirit of this view, we propose yet another framework for the analysis of the design and implementation problems surrounding DSS's: a framework which views the issues as marketing issues, and suggests the use of methods from marketing to help us structure some of

the problems faced. Briefly stated, the manager is the consumer, the information furnished by the DSS being the product purchased.

We suggest that the marketing perspective might give some new insights and some new tools to supplement (and not replace) those already in our tool kit. The rest of this paper attempts to support this last statement. In the first part of the paper we show why DSS's, and not so much Structured Decision Systems (SDS's), can profitably be viewed from a marketing perspective. In the second half of the paper we elaborate on some issues that the proposed framework has helped us focus on. Finally we describe a concrete tool to deal with some of the issues identified, and show the kind of data this instrument provides.

2. Replacement versus Support

The distinction between Decision Support Systems (DSS's) and Structured Decision Systems (SDS's) in terms of the type of task they are designed for, respectively unstructured and structured, leads to an important distinction in terms of the relationship between manager, technology and task. In the case of SDS's, the system typically replaces certain aspects of the decision making previously performed manually. In the case of DSS's, as implied by the name, the primary function of the system is support of the manager in his decision making.

The notion of support implies that the DSS only supplies part of the knowledge and information needed by the manager in defining and performing his task. The manager can therefore be viewed as being presented with a number of sources of information which supply different information or which supply the same information in different formats. Given the unstructured nature of the task, however, it is difficult for the manager to clearly evaluate which source of information is the most useful, even when the different sources present exactly the same information, but in a different format and with different availability. Note that the problem is not necessarily one of using only one of a number of sources to the exclusion of all other. Rather it is a decision on which set of sources to use, the set varying in size and the frequency of use varying over the set.

*The research reported herein was performed as part of a research project on the Impact of Conversational Computer Systems at the Sloan School of Management, M.I.T. - principal investigator: Prof. M. S. Scott Morton.

3. The Manager as a Consumer

The picture we have drawn suggests that the manager can be viewed as being faced with a choice among information sources, one of which could be the DSS, very similar to the choice facing a consumer in his purchase of goods. The primary equivalent of the consumer's payment for a good with cash, is the manager's payment for the use of an information source with a larger or smaller fraction of his valuable time.

If the manager is the consumer in our marketing framework, what is the product being purchased? The DSS itself is usually not purchased by the manager who uses the system. Such a purchase decision is an organizational decision. Rather, the manager purchases the information supplied by the DSS. This purchase is typically a recurring event, i.e., the DSS is continuously used. The information supplied by the DSS can therefore be considered similar to a frequently purchased product which in fact can be repeatedly "consumed" by the manager. On a complex DSS, the different functions on the system can in turn be considered as furnishing differentiated products with different "consumption" patterns.

4. Importance of Manager Perceptions

In a fashion similar to the consumer who only can compare a number of the goods he purchases in terms of the cost of the good, and must rely on subjective estimates of the value of the goods, the manager is rarely able to estimate objectively other than the cost (i.e., time) of using a certain source of information. Based on this observation, we suggest that following the choice paradigm down the path of information economies (e.g., as in [2]) is not necessarily the most profitable approach. Rather, we suggest that the issue be viewed more in marketing terms where a central issue is consumer attitudes and perceptions.

5. Purchase of Change as Opposed to Resistance Change

An important implicit assumption in our discussion has been that the manager has not been required to use the DSS or any other source of information by the organization in which he works. This assumption is based again on the nature of the task that a DSS is designed for. In unstructured tasks it is difficult for any person, the manager or his superior, to forcefully state that any particular limited source of information is necessary or sufficient. If this were not so, then the task would not be very unstructured. This leads us to note that while in the design and implementation of SDS's, one of the important issues faced at the interface between organization and the SDS is user resistance to a change imposed on them, in the case of DSS's, the corresponding issue is user purchase of the change.

In a fashion similar to the proposal of Lucas for a user-oriented approach to deal with the conflict and resistance to change [7], our proposal can be viewed as a consumer (= user)-oriented one to deal with the problem of developing a marketable change in the information technology available to the manager.

In unstructured tasks, the DSS is used in an independent fashion by the manager, his use of the DSS not impacting or affecting the performance of other entities in the organization in a direct fashion. This as opposed to SDS's for structured tasks, where the proper use of the system by any one individual manager is much more critical for overall system performance. Structured tasks are typically factored subtasks that have high interdependence with other tasks. In a sense, we can therefore consider an organizational entity as the "user" of a

SDS, while the individual manager is the user of a DSS.

We observe that one strategy for increasing DSS usage has precisely been to attempt to make usage of the DSS required in a task where the manager does interface with other entities in the organization. In marketing terms, this could be considered as a "tie-in-sale," where the manager has to purchase the DSS in his main task in order to perform well in the interfacing task. In the case of a DSS for portfolio management, the portfolio manager's superiors have started using the DSS in their regular account review meetings. These review meetings serve to monitor how the portfolio manager has invested his accounts. As a consequence, the portfolio manager has to at least use the DSS enough to be well prepared for the review meetings.

6. The Seller

Our view of who is the consumer in our marketing framework is much clearer than our understanding of who is the seller. The seller is a much more diffuse entity, being both superior managers concerned about an improvement in the potential DSS's users performance, and being the staff or entity that is responsible for the design, implementation and improvement of the DSS, such as M.I.S. function in an organization. Our framework does suggest that the individuals concerned with DSS usage should have a sales orientation. The finding of a recent survey of a number of on-line systems in operation [1], showing that not one of the systems were designed by the in-house M.I.S. function, indicates that a sales orientation might in fact be important. Typically, the staff of the M.I.S. function in an organization is at best user-oriented, and more commonly, M.I.S.-technology oriented. There is little in the setup of the M.I.S. function, normally geared to SDS's, that would bring out a marketing orientation. In fact, our perspective suggests that successful DSS's will typically be the result of out-of-house efforts, as out-of-house efforts will be the most likely to have the necessary marketing orientation in their design and implementation effort.

Summarizing our discussion to this point, we have argued that the managerial use of a DSS can fruitfully be viewed as a phenomenon very similar to consumer purchase of a frequently purchased good. The manager is the consumer, and the information furnished by the DSS is the product purchased. In a fashion similar to the firm producing and selling a consumer product, we therefore propose that in the design and implementation of a DSS one can view the issues partly as a marketing task.

7. Important Issues Identified with a Marketing Perspective

In concrete, more relevant terms to the designer and implementor, what are the issues that our proposed framework has identified?

We suggest that one important issue identified is putting in focus that the manager is faced with a number of more or less similar alternative products to choose from as sources of information in his task. When designing and implementing a DSS one should therefore be aware of competing and complementary products.

The marketing perspective has furthermore suggested that managerial perceptions of information sources might be an important issue. In a fashion similar to consumer perception of products or brands, managerial perception of the DSS should be seen as a possible critical determinant of manager use of the DSS, i.e., purchase of the product. In order to understand these perceptions, the perceptions should be considered relative to the perception of other

Information sources available to the manager. Obviously, the fact that a manager states that the DSS is useful, is much less meaningful than a statement that the DSS is more useful than most of the other sources of information available to him.

Finally, a marketing perspective naturally leads to a focus on DSS usage, the equivalent of sales volume. Based on recent experience with a large scale DSS, it would seem that predicting usage is a critical, but neglected task. Management of the organization that has implemented or is about to implement a DSS, has little past experience to determine what level of DSS usage is appropriate or to expect.

The prediction of DSS usage is not only important from the point of view of determining system capacity requirements. It is also important from the point of view of evaluating and monitoring system success. With a DSS it is difficult to evaluate success of the system directly in terms of improved task performance. This follows from the unstructured nature of the task. The main surrogate measure of success that management seems to rely on is therefore manager DSS usage, in a fashion similar to that an important criterion for evaluating success of a product is sales volume. We note here that it is not only important to predict DSS usage, but also to consider the possible impact of the DSS on the usage of other information sources. Some of these impacts might be desired and anticipated, but one should also consider and monitor for undesirable, and unanticipated impacts.

What tools or techniques do we have to aid us in dealing with the issues identified above? We shall here review an instrument, known as the Information Sources Role Construct Repertory Interview (Information Sources RCRI). Although there are a number of issues surrounding the use of this instrument that need to be researched, we think it already can be shown to be useful in mapping managerial perceptions of information sources. As we will discuss in the final section of this paper, such a mapping is in turn useful in the design of the DSS, might help us predict DSS usage patterns, and can guide our training or marketing program.

8. Information Sources Role Construct Repertory Interview

The Information Sources Role Construct Repertory Interview (Information Sources RCRI) is an extension of an interview technique initially developed to sample interpersonal perceptions [6]. The technique has been applied to sample perceptions of securities, portfolios, managerial problems, political parties and frequently purchased consumer product such as beverages and deodorants (see [11], [10], [9], [8]).

The RCRI is a three step interview enabling the manager first to identify a number of sources he is familiar with; secondly, to identify important dimensions or attributes along which he perceives that the different information sources can be differentiated; and finally, to rate the different sources identified in the first step along the attributes identified in the second step on a five point scale. The output of the interview can therefore be viewed as a matrix of ratings of information sources along attributes.

Fig. 1.A shows actual data obtained from such an interview administered to a portfolio manager in the trust department of a large bank that recently has installed an advanced DSS. (Instead of identifying the actual information sources, we have referred to them with the roles or situations used to identify familiar information sources in the first step of the RCRI).

From the raw data obtained in an Information Sources RCRI, we are able to develop a picture of the semantics, i.e., the meaning, of the manager's attributes, and his relative perception of the different sources available. The data can be analyzed in a number of fashions. We will briefly review one such analysis, based on a hierarchical cluster analysis of the perceptual data (ref. [5]), in order to present, in more concrete terms, the potential of the RCRI.

In general terms, cluster analysis is a technique to determine important and meaningful groupings or clusters of objects. Hierarchical cluster analysis is a particular technique that generates a sequence of clusterings having the property that any cluster is a merging of two or more clusters in the immediately preceding clustering. At any stage, the choice of clusters to be merged is the pair of most similar clusters. The output is a hierarchical diagram which is simply a graphical record of the sequence of mergings.

In fig. 1.B, we have analyzed the data with a focus on the information sources. From the clustering, we find that this manager perceives the most useful function on the DSS as most similar to the Quotron, a terminal based service (independent of the DSS) that reports real time data on security prices and sales volume on the stock market. This is an interesting finding, given that the actual DSS in question here was designed to support the manager in planning changes in his portfolios using projected data on individual securities.

Fig. 2.A shows a hierarchical cluster analysis of the same data, this time with a focus on the attributes or dimensions identified by the manager in the second step of the RCRI. We find that the cluster comprising attributes 14, 7, 8, 6, and 16 indicate that this manager perceives that information on "what one should have in an account" is distorted, inexact, unrealistic and cannot be relied on. Furthermore, the analysis indicates, interestingly, that usefulness of an information source is most strongly tied to whether or not this manager can "relate to" or "get a feel about the data given by" the information source.

Finally, in Fig. 2.B, we show the three DSS commands or functions identified by the manager have been rated. From attribute 2, "visual, graphical vs. numbers, tables," we see that the most useful function gives numerical data in table form, while both the least useful command and the most difficult command to use are graphical functions. From the rest of the attributes, we can summarize this manager's views as seeing the graphical functions, relative to the numerical DSS function, as more inexact, less realistic, less dependable, not as easy to communicate with, not giving as much of the total picture, good for showing extremes, not as useful, less easy to relate to, and giving less background information.

9. The Design and Implementation Process

Let us finally discuss how we propose that the Information Sources RCRI be used. This can be best done within a process model of the design and implementation of a DSS. With our marketing perspective, the process can be viewed as:

- (1) creating and designing new product concepts;
- (2) screening new brands;
- (3) test marketing;
- (4) national introduction;
- (5) monitoring and evaluating brand sales (ref. 8).

In DSS terms, the process can therefore be viewed as (ref. fig. 3): (1) creation and initial design of a new DSS; (2) user screening of alternate DSS designs; (3) implementation and use of prototype DSS; (4) redesign and implementation of operational DSS; (5) monitoring and evaluating DSS usage.

Although we think that the Information Sources RCRI can be profitably used in most of the steps of the design and implementation process as a tool to sample and monitor manager perceptions, we feel its use can best be discussed concretely in terms of helping us manage the test marketing of the DSS, i.e., evaluate the experience gained from prototype implementation and use. Our experience suggests that this presently is done in a rather ad-hoc fashion.

The procedure proposed is to sample manager perceptions prior to their use of the prototype but after they have been exposed to the DSS concept in a fashion similar to a training introduction to the system. After prototype use, manager perceptions of information sources is again sampled.

With pre- and post- prototype RCRI data, we can then proceed to

1) evaluate the managers reactions to the DSS in terms relative to the other information sources using the post-prototype RCRI. This is both an evaluation in terms of clarifying what level of understanding of the DSS the manager reactions are based on. (Research is in progress on trying to combine data on manager perceptions with actual manager usage of information sources in order to define what might be an "ideal" information source (ref. [8])). This seems as a promising fashion to summarize the large quantity of data obtained using the RCRI).

2) together with DSS usage data, explore the effect of different pre-prototype perceptions on manager trial-purchase and repeat-purchase patterns. This can in turn be used to guide the main DSS training and marketing effort. Furthermore, it might serve to help us estimate DSS usage (ref. [8]).

10. Summary

In more general terms, we are suggesting that the Information Sources RCRI is a useful instrument to generate data that in turn can help us manage and guide certain aspects of the DSS design and implementation process. The thrust of this paper is that the usefulness of the RCRI is best seen when one looks at DSS design and implementation from a marketing perspective.

As our discussion implies, we have been considering the marketing perspective not in a consumer manipulation sense, but rather in the sense of managing and improving the two way communication between consumer and designer. We are not arguing that the marketing perspective replace other perspectives, but rather be seen as a supplement to such techniques as a decision centered approach. The design and implementation of systems to support decision making in unstructured tasks can itself be considered an even more unstructured and complex task in need of all the technology, both conceptual and analytical, that we can focus on the issue. There is in fact room and need for more than one perspective or approach.

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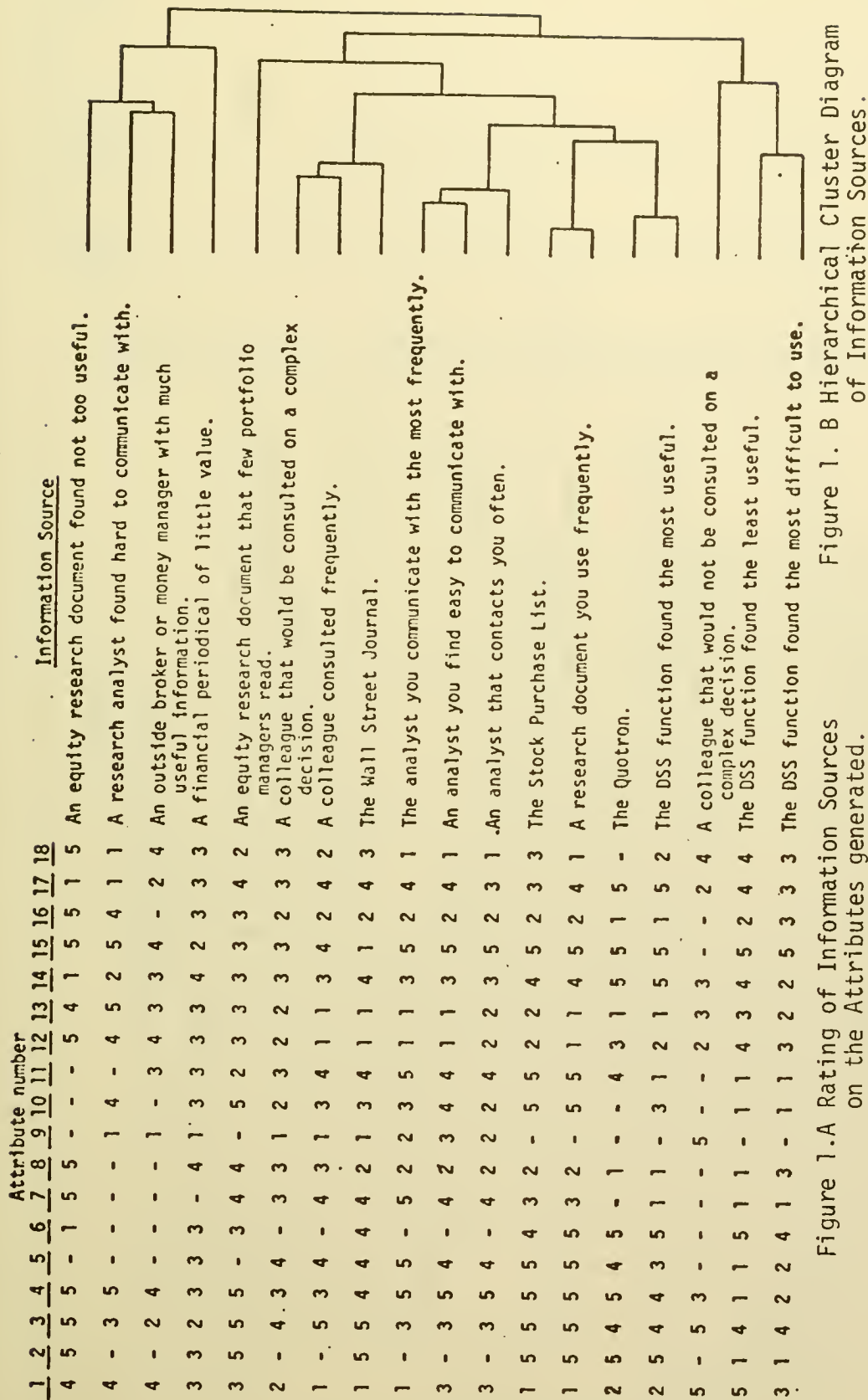


Figure 1.A Rating of Information Sources on the Attributes generated.

Figure 1. B Hierarchical Cluster Diagram of Information Sources.

Figure 1. Rating and Hierarchical Cluster Diagram of data obtained from an Information Sources Role Construct Repertory Interview with a portfolio manager from the Trust Department of a large bank that has recently installed an advanced Decision Support System.

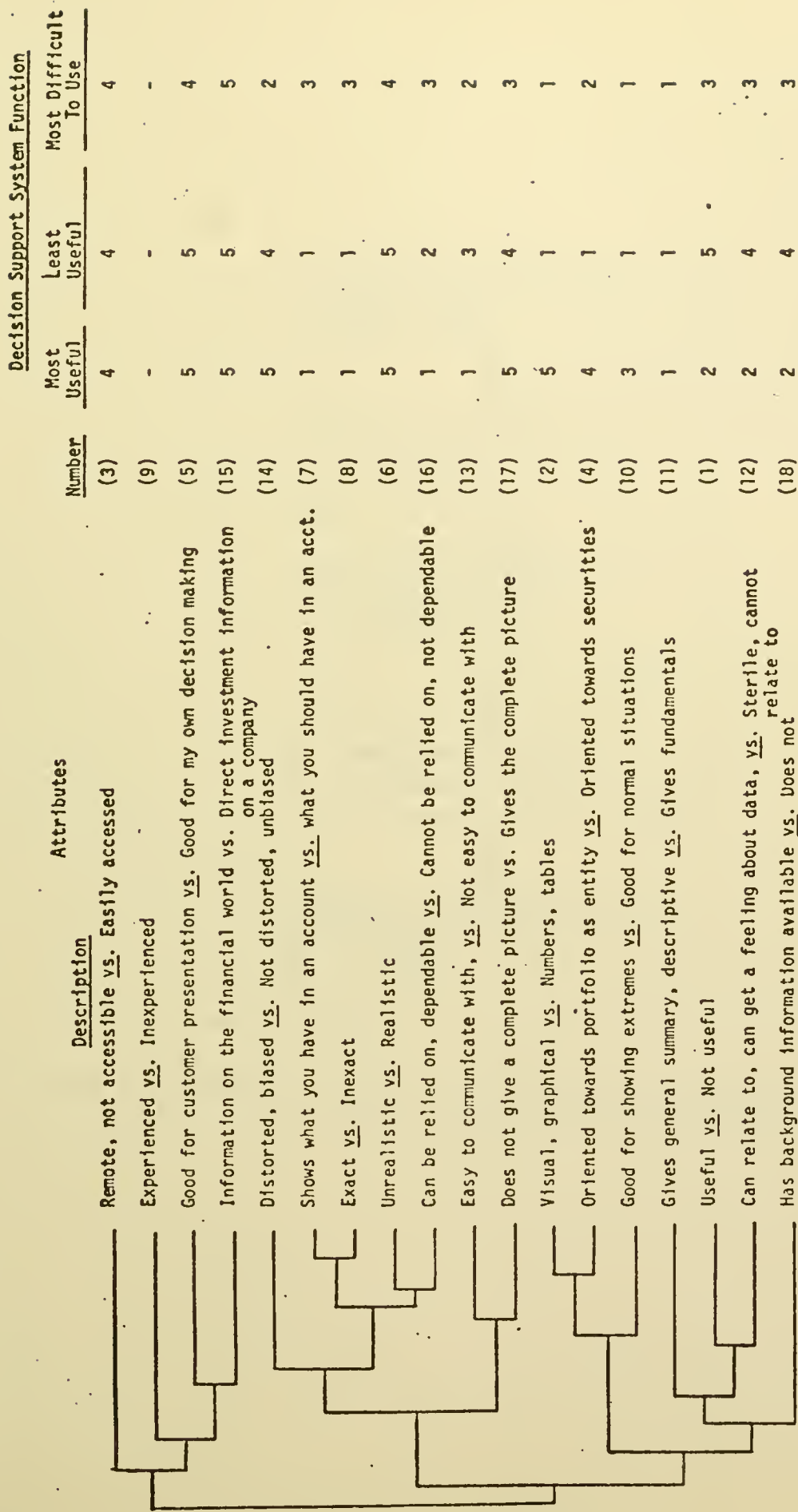


Figure 2.A Hierarchical Cluster Diagram of attributes

Figure 2.B Rating of Decision Support System Functions.

Figure 2. Hierarchical Cluster Analysis of Attributes and Rating of Decision Support System Functions using the same data as presented in Figure 1..

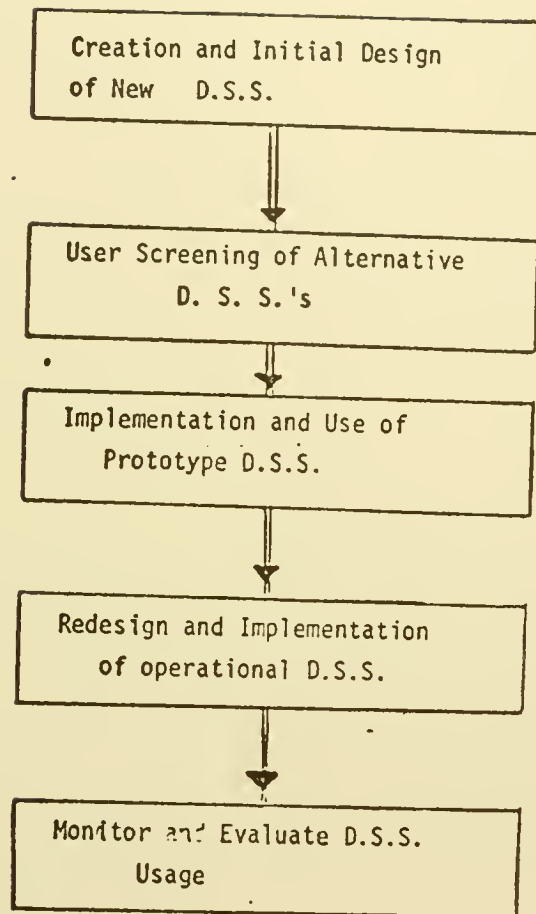


Figure 3. The Decision Support System Design and Implementation Process.

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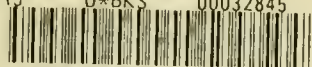
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